

CLAIMS

1 – Process for producing dichloropropanol, according to which glycerol is subjected to a reaction with a chlorinating agent, with the exception of a reaction carried out in the presence of acetic acid or its derivatives.

5        2 - Process according to claim 1, wherein the reaction is carried out continuously.

3 – Process according to claim 1 or 2, wherein the chlorinating agent comprises substantially anhydrous hydrogen chloride.

10      4 – Process according to claim 1 or 2, wherein the chlorinating agent is an aqueous solution of hydrogen chloride with a hydrogen chloride content higher than or equal to 4 % by weight, preferably higher than or equal to 20 % by weight, and most preferably higher than or equal to 30% by weight.

5 – Process according to any of claims 1 to 4, wherein the reaction is carried out in the liquid phase.

15      6 – Process according to any of claims 1 to 5, wherein, a carboxylic acid, a carboxylic acid anhydride, a carboxylic acid chloride, a carboxylic acid salt or a carboxylic acid ester preferably having an atmospheric boiling point of greater than or equal to 200°C, is used as the catalyst.

20      7 – Process according to claim 6 wherein, the catalyst is adipic acid, adipic acid anhydride, adipic acid chloride, adipic acid salt or adipic acid ester.

25      8 – Process according to claim 6 or 7 wherein the acid concentration in the reaction medium expressed in mole of acid and of acid esters derivatives per kg of liquid reaction medium is higher than or equal to 0.1 and lower than or equal to 10.

9 – Process according to any of claims 1 to 8, wherein the reaction is carried out in the presence of at least one organic solvent.

10 – Process according to claim 9, wherein the solvent comprises chloropropanediol and/or dichloropropanol and/or heavy by-products of the reaction.

11 – Process according to any of claims 1 to 10 wherein the water concentration in the reaction mixture is lower than or equal to 15% by weight.

12 – Process according to any of claims 1 to 11 wherein reaction conditions are adjusted in such a way that the concentration of hydrogen chloride in the gas phase above the liquid reaction mixture remains lower than the concentration of hydrogen chloride in the binary azeotropic hydrogen chloride-water mixture.

13 - Process according to any of claim 1 to 12, in which continuous or periodic withdrawal of a fraction comprising at least water with a hydrogen chloride content equal to or less than 10% by weight relative to the total weight of the fraction comprising water and optionally dichloropropanol is carried out, and the reaction medium is optionally fed with water, in particular with steam.

14 – Process according to any of claims 1 to 13, wherein the reaction is carried out in a reactor made of materials that are resistant, under the conditions of reaction, to the chlorinating agent and are selected from enamelled steel, polymers, coatings by means of resins, metals or alloys, ceramics and metalloceramics and refractory materials.

15 – Process for producing dichloropropanol according to any of claims 1 to 14 wherein reactor (20) is fed, in a continuous or batch mode, with glycerol via line (21) and catalyst via line (22), the feed of hydrogen chloride, anhydrous or in aqueous solution, is carried out continuously or in batch-mode via line (23), a distillation column (30) is fed via line (24) with vapour produced from reactor (20), a stream is withdrawn from column (30) via line (26) and optionally fed to decantor (31) in which aqueous and organic phases are separated.

16 – Process for producing dichloropropanol according to any of claims 1 to 15 wherein a reactor (33) is continuously or batch fed with glycerol via line (41) and catalyst via line (42), the feed of hydrogen chloride, anhydrous or in aqueous solution, is carried out continuously or in batch-mode through line (43), a distillation column (42) is fed via line (34) with the vapour produced from reactor (33), the residue from column (42) is recycled via line (35) to the reactor (33), a purge from the reactor bottom is fed via line (37) into a stripper (44) wherein a partial stripping operation is carried out e.g. by heating or by gas sweeping with nitrogen or steam, the gas phase containing most of the hydrogen

chloride from stream (37) is recycled via line (38) to the column (42) or via line (45) to the reactor (33), a distillation or stripping column (43) is fed with the liquid phase arising from the stripper (44) via line (39), the main fraction of dichloropropanol is collected from the top of the column through line (40) and 5 the column residue is recycled via line (41) to the reactor (33).

17 – Process according to any of claims 15 to 16 wherein

- (a) a liquid phase is withdrawn from reactor (20) or (33)
- (b) a, preferably azeotropic, hydrogen chloride/water mixture is added to the liquid phase and the resulting mixture is then heated
- 10 (c) the acid is recovered from this resulting mixture, for example by crystallization and optionally recycled to reactor (20) or (33).

18 – Process according to claim 17 wherein water is added to the resulting mixture from step (b) and the acid catalyst is recovered by crystallization and recycled to the reactor (20) or (33).

15 19 – Process according to anyone of claims 1 to 18, wherein 1,3-dichloropropan-2-ol is obtained with a selectivity of at least 50%.

20 – Process according to anyone of claims 1 to 19, wherein the glycerol used has at least partially been produced from renewable raw materials

21 – Pseudo-azeotropic composition consisting essentially of 20 dichloropropanol, hydrogen chloride and water.

22 – Process for producing organic compounds comprising

- (a) a first step wherein glycerol is produced from renewable raw materials and
- (b) a second step wherein organic compounds are produced from glycerol obtained in the first step.

25 23 – Process according to claim 22, wherein the glycerol used in the second step is a crude product comprising besides, water and a metal salt, preferably selected from NaCl, KCl, sodium sulfate and potassium sulfate.

24 – Process according to claim 23 wherein the crude product comprises from 40 to 99 % by weight of glycerol, from 5 to 50% by weight of water and from 1 to 10 % by weight of metal salt.

25 – Process according to claim 22, wherein the glycerol used during the 5 second step is a purified product.

26 – Process according to claim 25, wherein the purified product contains from 80 to 99.9 % by weight of glycerol and from 0.1 to 20 % by weight of water.

27 – Process according to any of claims 22 to 26, wherein the glycerol is 10 obtained by conversion of animal fats or has been obtained during the manufacture of biodiesel.

28 – Integrated process of production according to claim 27 according to which

- (a) a plant oil is subjected to a trans-esterification reaction with an alcohol other 15 than glycerol, preferably methanol or ethanol, so as to recover at least biodiesel and a crude product containing glycerol ;
- (b) the crude product is optionally subjected to a purification operation such as distillation ;
- (c) glycerol formed in step (a) is subjected to the process for producing an 20 organic compound.

29 – Process according to claim 28, according to which the steps of production of glycerol and of production of the organic compound are carried out on the same production site.

30 – Process according to claim 28, according to which the steps of 25 production of glycerol and of production of the organic compound are carried out on different production sites.

31 – Process for producing epichlorhydrin wherein

- (a) dichloropropanol is produced in accordance with a process according to anyone of claims 1 to 30;

(b) at least one fraction of the obtained dichloropropanol is subjected to a dehydrochlorination reaction.

5 32 – Process according to any of claims 22 to 31, wherein, glycerol is contacted with at least one condensing agent or with epichlorohydrin, possibly in the presence of a base, and polyglycerol is obtained.

33 – Process for producing epoxy resins according to which epichlorohydrin derived from the process according to claim 31 is used as starting material.

10 34 – Process for producing epoxy resins wherein dichloropropanol containing at least 50% by weight of 1,3-dichloropropane-2-ol relative to the total dichloropropanol is used as the starting material.

35 – Process according to claim 6 wherein, the catalyst is a dicarboxylic acid, a dicarboxylic acid anhydride, a dicarboxylic acid chloride, a dicarboxylic acid salt or a dicarboxylic acid ester

15 36 – Process for separation of a mixture containing at least water, dichloropropane and hydrogen chloride wherein the mixture is separated in a distillation step wherein the sum of materials fed to said distillation step has a hydrogen chloride concentration which is lower than the hydrogen chloride concentration in the binary azeotropic composition hydrogen chloride/water at 20 the pressure of the distillation.